CLAIMS:

1. A method for selecting a cementing composition intended for use in a subterranean zone penetrated by a well bore comprising:

determining a total maximum stress difference for a cementing composition using data from the cementing composition;

determining well input data; and

comparing the well input data to the total maximum stress difference to determine whether the cementing composition is effective for the intended use.

2. The method of claim 1 wherein the data from the cementing composition comprises at least one of tensile strength, unconfined and confined tri-axial data, hydrostatic data, oedometer data, compressive strength, porosity, permeability, Young's modulus, Poisson's Ratio, and Mohr-Coulomb plastic parameters.

3. The method of claim 1 wherein the total maximum stress difference is determined according to the formula

$$\Delta\sigma_{sh} = k \int_{\varepsilon_{sh}^{set}}^{\varepsilon_{sh}^{tot}} E_{(\varepsilon_{sh})}.d\varepsilon_{sh}$$

where:

$\Delta\sigma_{sh}$ is the total maximum stress difference;

k is a factor depending on the Poisson ratio of the cementing composition and the boundary conditions between rock in the subterranean zone penetrated by the wellbore and the cementing composition;

$E_{(\varepsilon_{sh})}$ is the Young's modulus of the cementing composition; and

ε_{sh} represents shrinkage of the cementing composition at a time during setting.

4. The method of claim 1 wherein said determining of the well input data comprises determining at least one of vertical depth of the well, overburden gradient, pore pressure, maximum and minimum horizontal stresses, hole size, casing outer diameter, casing inner diameter, density of drilling fluid, density of cement slurry, density of completion fluid, and top of cement.

5. The method of claim 1 wherein said determining of the well input data comprises evaluating a stress state of rock in the subterranean zone penetrated by the well bore.

6. The method of claim 5 wherein said evaluating the stress state of the rock comprises analyzing properties of the rock selected from the group consisting of Young's modulus, Poisson's ratio and yield parameters.

7. The method of claim 1 further comprising determining risk of failure for the cementing composition determined to be effective for the intended use.

8. The method of claim 1 further comprising

determining at least one well event stress state associated with at least one anticipated well event; and

comparing the well input data to the at least one well event stress state to determine whether the cementing composition is effective for the intended use.

9. The method of claim 8 wherein the anticipated well event comprises at least one well event selected from the group consisting of cement hydration, pressure testing, well completions, hydraulic fracturing, hydrocarbon production, fluid injection, formation movement, perforation, and subsequent drilling.

10. The method of claim 8 wherein said determining of the well event stress state comprises determining stress associated with at least one anticipated well event selected from the group consisting of shrinkage, pressure, temperature, load, and dynamic load.

11. The method of claim 1 wherein the cementing composition is selected from the group consisting of cement with a Young's modulus of about 1.2e+6 psi (8.27GPa), shrinkage compensated cement with a Young's modulus of about 1.2e+6 psi (8.27GPa), and shrinkage compensated cement with a Young's modulus of about 1.35e+5 psi (0.93 GPa).

12. A method for selecting a cementing composition intended for use in a subterranean zone penetrated by a well bore comprising:

defining initial conditions in the well bore by evaluating a stress state of rock in the subterranean zone penetrated by the well bore and evaluating a stress state associated with a cement composition introduced into the well bore; and

determining whether the cementing composition is effective for the intended use by determining whether the cement composition will de-bond from the rock.

13. The method of claim 12 wherein the evaluating of the stress state associated with the cement composition introduced into the well bore comprises using data associated with the cementing composition that comprises at least one of tensile strength, unconfined and confined tri-axial data, hydrostatic data, oedometer data, compressive strength, porosity, permeability, Young's modulus, Poisson's Ratio, and Mohr-Coulomb plastic parameters.

14. The method of claim 12 wherein said evaluating the stress state of the rock in the subterranean zone comprises analyzing properties of the rock selected from the group consisting of Young's modulus, Poisson's ratio and yield parameters.

15. The method of claim 12 further comprising:

determining at least one well event stress state associated with at least one anticipated well event; and

determining whether the cementing composition will de-bond from the rock.

16. The method of claim 15 wherein the anticipated well event comprises at least one well event selected from the group consisting of cement hydration, pressure testing, well completions, hydraulic fracturing, hydrocarbon production, fluid injection, formation movement, perforation, and subsequent drilling.

17. The method of claim 15 wherein said determining of the well event stress state comprises determining stress associated with at least one anticipated well event selected from the group consisting of shrinkage, pressure, temperature, load, and dynamic load.

18. A method of performing a cost-benefit analysis on a cementing composition intended for use in a subterranean zone penetrated by a well bore comprising:

determining a total maximum stress difference for a cementing composition using data from the cementing composition;

determining well input data;

comparing the well input data to the total maximum stress difference to determine whether the cementing composition is effective for the intended use;

determining at least one well event stress state associated with at least one anticipated well event;

comparing the well input data to the at least one well event stress state to determine whether the cementing composition is effective for the intended use;

determining the risk of failure for the cementing composition determined to be effective for the intended use; and

determining whether the risk of failure is acceptable given monetary costs associated with the cementing composition.

19. The method of claim 18 wherein the data from the cementing composition comprises at least one of tensile strength, unconfined and confined tri-axial data, hydrostatic data, oedometer data, compressive strength, porosity, permeability, Young's modulus, Poisson's Ratio, and Mohr-Coulomb plastic parameters.

20. The method of claim 18 wherein the total maximum stress difference is determined according to the formula

$$\Delta\sigma_{sh} = k \int_{\varepsilon_{sh}^{set}}^{\varepsilon_{sh}^{tot}} E_{(\varepsilon_{sh})} . d\varepsilon_{sh}$$

where:

$\Delta\sigma_{sh}$ is the total maximum stress difference;

k is a factor depending on the Poisson ratio of the cementing composition and the boundary conditions between rock in the subterranean zone penetrated by the well bore and the cementing composition;

$E_{(\varepsilon_{sh})}$ is the Young's modulus of the cementing composition; and

ε_{sh} represents shrinkage of the cementing composition at a time during setting.

21. The method of claim 18 wherein said determining of the well input data comprises determining at least one of vertical depth of the well, overburden gradient, pore pressure, maximum and minimum horizontal stresses, hole size, casing outer diameter, casing inner diameter, density of drilling fluid, density of cement slurry, density of completion fluid, and top of cement.

22. The method of claim 18 wherein said determining of the well input data comprises evaluating a stress state of rock in the subterranean zone penetrated by the well bore.

23. The method of claim 22 wherein said evaluating the stress state of the rock comprises analyzing properties of the rock selected from the group consisting of Young's modulus, Poisson's ratio and yield parameters.

24. The method of claim 18 wherein the anticipated well event comprises at least one well event selected from the group consisting of cement hydration, pressure testing, well completions, hydraulic fracturing, hydrocarbon production, fluid injection, formation movement, perforation, and subsequent drilling.

25. The method of claim 18 wherein said determining of the well event stress state comprises determining stress associated with at least one anticipated well event selected from the group consisting of shrinkage, pressure, temperature, load, and dynamic load.

26. A method for selecting a cementing composition intended for use in a subterranean zone penetrated by a well bore comprising:

determining a total maximum stress difference for a cementing composition using data from the cementing composition;

determining well input data;

comparing the well input data to the total maximum stress difference to determine at least in part whether the cementing composition is effective for the intended use;

determining at least one well event stress state associated with at least one anticipated well event; and

comparing the well input data to the at least one well event stress state to determine whether the cementing composition is effective for the intended use.

27. The method of claim 26 wherein the data from the cementing composition comprises at least one of tensile strength, unconfined and confined tri-axial data, hydrostatic data, oedometer data, compressive strength, porosity, permeability, Young's modulus, Poisson's Ratio, and Mohr-Coulomb plastic parameters.

28. The method of claim 26 wherein the total maximum stress difference is determined according to the formula

$$\Delta\sigma_{sh} = k \int_{\varepsilon_{sh}^{set}}^{\varepsilon_{sh}^{tot}} E_{(\varepsilon_{sh})} . d\varepsilon_{sh}$$

where:

$\Delta\sigma_{sh}$ is the total maximum stress difference;

k is a factor depending on the Poisson ratio of the cementing composition and the boundary conditions between rock in the subterranean zone penetrated by the wellbore and the cementing composition;

$E_{(\varepsilon_{sh})}$ is the Young's modulus of the cementing composition; and

ε_{sh} represents shrinkage of the cementing composition at a time during setting.

29. The method of claim 26 wherein said determining of the well input data comprises determining at least one of vertical depth of the well, overburden gradient, pore pressure, maximum and minimum horizontal stresses, hole size, casing outer diameter, casing inner diameter, density of drilling fluid, density of cement slurry, density of completion fluid, and top of cement.

30. The method of claim 26 wherein said determining of the well input data comprises evaluating a stress state of rock in the subterranean zone penetrated by the well bore.

31. The method of claim 30 wherein said evaluating the stress state of the rock comprises analyzing properties of the rock selected from the group consisting of Young's modulus, Poisson's ratio and yield parameters.

32. The method of claim 26 further comprising determining risk of failure for the cementing composition determined to be effective for the intended use.

33. The method of claim 26 wherein the anticipated well event comprises at least one well event selected from the group consisting of cement hydration, pressure testing, well completions, hydraulic fracturing, hydrocarbon production, fluid injection, formation movement, perforation, and subsequent drilling.

34. The method of claim 26 wherein said determining of the well event stress state comprises determining stress associated with at least one anticipated well event selected from the group consisting of shrinkage, pressure, temperature, load, and dynamic load.